CBRN HAZARD MITIGATION AND GEOSPATIAL DATA:

A SYNERGISTIC APPROACH

By Major Jared (Jay) Ware

In regions where increasing numbers of people occupy a finite and densely crowded area, urbanization, migration, public health, and refugees are factors of growing strategic importance.

—Field Manual (FM) 3-100.4

Due to recent military operations in Afghanistan and Iraq, the Chemical Corps has taken on an increased role in protecting forces and civilians from industrial and environmental threats. One mission in particular—hazard mitigation—has increased in scope due to the presence of industrial infrastructure within the urban battlespace. Not only do adversaries pose chemical, biological, radiological, and nuclear (CBRN) hazards through a variety of weapon systems, but the industrial infrastructure also creates new and additional threats. Coalition forces must protect the infrastructure from terrorist activities and monitor operations to ensure that environmental hazards do not occur. CBRN personnel can use geospatial information and engineering systems (available at various staff echelons) to better predict, track, assess, and mitigate hazards. The use of these systems allows for a synergistic and effective approach to CBRN hazard mitigation and force protection.

Hazard Mitigation

CBRN hazard mitigation requires an understanding of the threats within the area of operations (AO) and defined areas of interest. Environmental threats to stability and security might result from acts of war or terrorism that destroy the infrastructure (petrochemical facilities, power plants, nuclear sites). Moreover, environmental threats such as polluted air or water may result from routine activities of an industrial society.[1] These threats should be identified, defined, and prioritized by Chemical, engineer, and medical planners of the environmental protection cell (EPC) during mission analysis. Members of the cell can use geographic information systems (GISs) and geospatial engineering to plot and track the threats, perform predictive analysis, and collect geospatial intelligence.

Geospatial Advantage

Geospatial intelligence (GEOINT) refers to the exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities such as CBRN incidents.[2] Information about incidents can be entered into the GIS database, appropriately labeled, referenced by geolocation, and displayed on digital imagery and three-dimensional digital elevation models. This allows the EPC to maintain a credible data set with robust layers of information that can be easily updated for current or predictive analysis. Geospatial engineering hardware systems such as the Digital Topographic Support System contain special suites of software (ArcGIS, ERDAS IMAGINE) used by geospatial analysts to visualize the battlespace and analyze the terrain. The systems are capable of accepting various forms of data (imagery, Global Positioning System points) that enhance CBRN analysis and support hazard mitigation.

Synergy Achievement

The overall goal of hazard mitigation is to prevent CBRN threats from becoming incidents that could harm personnel or equipment. In the current operational environment, insurgents can obtain relatively cheap, easy-to-make CBRN weapons. These weapons can be used directly against personnel or critical infrastructure to produce a CBRN industrial or environmental incident.

EPC staff expertise and the ability to predict, visualize, and assess potential threats are required to mitigate those threats and protect the force and critical infrastructure.

The EPC staff can use geospatial information, engineering systems, and intelligence analysis to war-game potential courses of action. Maps and imagery can be used to identify critical facilities within an AO. The descriptions and locations of the facilities can then be entered into a GIS database. The EPC staff can use this information to develop a protection plan. Figure 1 shows a sample analytical product that can be generated in this manner. It illustrates the results of a line-of-sight analysis conducted for a prominent intersection within the industrial area of a city. The 360° analysis indicates, within a radius of 10 kilometers, which facilities can and cannot be observed from the intersection. A line-of-sight analysis such as this allows the EPC staff to determine optimal locations for critical infrastructure observation posts within the AO.

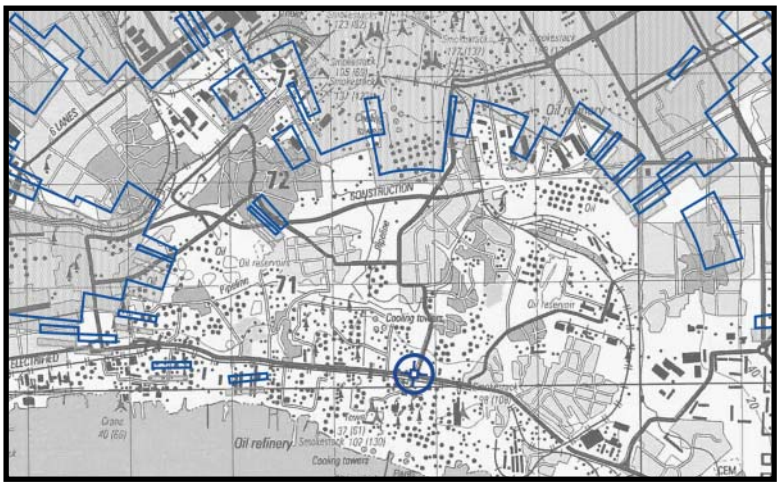

Figure 1. Sample line-of-sight analysis for critical infrastructure observation posts. The areas outlined in blue are those that cannot be observed from the intersection (within circle).

The EPC staff can also develop predictive analyses to ensure that proper actions are taken for CBRN incidents and that proper resources are devoted to incident responses. Figure 2 represents a downwind plot for a hypothetical CBRN incident in a populated area. In this case, the question is whether the Lake Ridge Executive Park needs to be evacuated. The GIS analysis indicates that the incident poses no threat to the park.

A number of scenarios can be analyzed for various locations, infrastructure designs, and chemical agents. Using this information, the EPC staff can determine the probable and most likely scenarios and can develop plans to mitigate potential hazards.

Conclusion

In the current operating environment, Chemical Corps Soldiers work with engineer and medical personnel to mitigate industrial and environmental hazards. Geospatial information allows for more effective mitigation of CBRN hazards and, consequently, improved force protection. Geospatial engineering and intelligence allow the EPC staff to better understand adversaries and the threats that they pose to military operations within an AO. Incorporating geospatial data into the planning process facilitates a synergistic approach to CBRN hazard mitigation.

Endnotes:

[1]FM 3-100.4, *Environmental Considerations in Military Operations*, 15 June 2000.

[2]GEOINT Publication 1-0, *Geospatial Intelligence (GEOINT) Basic Doctrine*, National Geospatial Intelligence Agency, Office of Geospatial-Intelligence Management, September 2006.

Reference:

FM 3-100.4, *Environmental Considerations in Military Operations*, 15 June 2000.

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Figure 2. Downwind plot for predictive analysis within a populated area.